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THE BLACK ARMY CUTWORM

A Blueberry Pest

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THE BLACK ARMY CUTWORM¹ *JS*

A Blueberry Pest²

BY C. R. PHIPPS

INTRODUCTION

The black army cutworm has been known for many years in the United States and Canada. Its activities have always been confined to the more northern regions (20)³. In fact it was first observed and described from Moscow, Russia (21) in 1806. Since then it has been recorded from Lapland, Siberia, and, according to Fernald (6), "even as far East as Amoor Island". It appears likely that the species originated in Europe and eventually crossed the Bering Straits, for it was not recorded in North America (12) until 1874, over fifty years after it was first described and named. In common with several other cutworms this species has the army worm habit of movement when present in large numbers. In certain localities it has been referred to as the "black-lined cutworm" and the "erratic army worm". During periods of great abundance it will feed upon a great variety of plants. However, it was not until the spring of 1925 that it was recorded as a blueberry pest.

HISTORY AND DISTRIBUTION IN NORTH AMERICA

There are several early records of the black army cutworm from Canada where it is widely distributed. In 1875 Norman caught some of the moths at St. Catherines (15) and the same writer in 1876 lists it from Orillia (16). Since then Canada has suffered many serious attacks by this insect. Caesar (2) in 1912 reports that, "From Monteith, in New Ontario (Canada),

¹*Agrotis fennica* Tauscher.

²Papers from the Maine Agricultural Experiment Station: Entomology No. 122.

³Reference is made by number (*italic*) to "Literature cited," p. 215.

and also from Port Arthur and Parry Sound came complaints of countless numbers of the Black Army Worm. The correspondents said that they had destroyed all kinds of vegetation for several miles in extent." Gibson (9, p. 28) in 1915 referred to this cutworm as follows: "Although this insect is widely distributed in Canada most of the complaints of injury by the caterpillars have been received from the provinces of Ontario and Quebec". The same writer (10) in 1919 reported an outbreak on clover in several towns in Alberta.

Similarly there are many early records of outbreaks in various parts of the United States. Grote (12) in 1874 found the moths in California. Its known distribution in the United States includes Maine, New Hampshire, Connecticut (1), New York, Michigan (3), Minnesota (13), and California.

One of the earliest outbreaks in this country occurred in Michigan in 1884. Cook (3) states that this cutworm was very abundant in the vicinity of Bay City and Saginaw City, also on the shores of Lake Huron and Lake Michigan. Some idea of its numbers may be gained from Cook's statement that "in a meadow that I visited at West Bay City, the caterpillars were so numerous that to step was to kill a score." In that connection he adds that on damp, cloudy days they frequently worked by daylight. Luggar, in 1896, reported (14) a similar widespread outbreak of this species in Minnesota. He made the following statement: "All of the foliage since the great fire of 1893 seemed to be to the taste of these worms. They preferred, however, such plants that are bitter, hence the foliage of cherries, poplars, willows, and sumachs was the first to be eaten; after these plants had been denuded nearly all others were devoured and only certain grasses fared better."

More recently Britton (1) in 1925 reports the destructive attack of this insect on apple trees in a nursery in Durham, Connecticut. Pettit (18) in 1925, records an unusually severe outbreak in Michigan where it fed upon a wide variety of plants.

IMPORTANCE IN MAINE

As early as 1884 Maine suffered a serious outbreak of the black army worm. According to Cook (4) "a rare insect, the black army worm, has appeared in the state". The attack was

first noticed in the vicinity of Waterville in the early summer of 1884. Strawberry plants, in particular, were destroyed as well as peas, asparagus, and many other crops.

During 1924 this cutworm was present in Maine and did conspicuous damage. In May, 1925, Maine experienced another and even more serious attack. As stated above, the insect has a wide range of food plants but it so happens that the blueberry, prior to 1925, had never been noted as one of them. The damage done by the black army cutworm in 1925 was tremendous. Many blueberry fields in different parts of the state were stripped, first of buds and later of blossoms and leaves. A survey of the situation by the Experiment Station during the summer revealed the fact that the damage was distributed thruout the entire blueberry producing section of the state. This territory extends from Portland to Calais and includes part of York, Cumberland, Penobscot, Washington, and Hancock Counties. Thruout this area blueberry growers suffered individual losses varying from \$500 to \$2500, and one grower reported a loss of over \$8000. It is safe to say that the loss in Hancock County alone was in the neighborhood of \$100,000. Other crops were attacked also, especially garden plants and nursery trees. One thousand seedling apple trees in a nursery near Monmouth were reported to be seriously injured.

In 1926 the season was much later than in 1925 and relatively few of these cutworms appeared. However, as early as May 5 (1926), a few very small black army cutworms, in common with several other species, were taken by the writer near Brunswick (Cumberland County) feeding on swelling blueberry buds. Although they were not found on the mainland in Washington or Hancock Counties at this time they did occur in considerable abundance on Long Island (Hancock County) over a month later. This cutworm shortened the blueberry crop on the island between one and two hundred bushels. The damage caused by this and accompanying cutworms in the Brunswick fields was considerably less.

It is entirely reasonable to suppose that this insect is not as new in its role as a blueberry pest as has been assumed by some. Reports of peculiar "frosts" which often struck only the ridges or which were singularly localized, as well as accounts of crop failure from unknown causes, make it appear likely that this species has been active in blueberry fields for a number of years. Since

these cutworms are chiefly active at night and are ordinarily hidden away by day it is not so strange that they have escaped the attention of the growers, possibly for a long time.

DESCRIPTION

Larva or caterpillar. The small, immature caterpillars are velvety black in color, at first, and their bodies are marked with four faint white lines. Later, as they become larger, the general body color changes to a brownish black with distinct whitish or yellowish markings running the length of the body. Close examination shows that these lines or markings are often broken or irregular. A shiny black central line extends along the middle of the back. This is made up of a series of velvety black diamond-shaped marks of which there is one on every body segment except the first. On each side and just below this central black line is a broken white line margined above with black. Below these lateral white lines are wide black bands. Just below the bands and extending along the lower edge of the spiracles are wide, zig zag, white stripes which are more or less mottled with brown or red as the insect becomes nearly full grown. (Fig. 29, A). Beneath, the body varies from nearly black to grey, brown, or olivaceous. The sides of the head, legs, and anal area are yellowish brown. The body bears a number of black tubercles or swellings from each of which arises a black bristle or hair. The full grown caterpillars are from one and a half to one and three-quarters inches in length.

Pupa. The pupa is about three-quarters of an inch in length and light, shiny brown in color. It has a terminal forked spine. (Fig. 29, E).

Adult or moth. The moth, with its wings spread, measures about an inch and a half across. The upper wings are a shiny blackish brown except for small round and kidney shaped spots. The round or orbicular spots have dark centers outlined in light yellow. The reniform or kidney shaped spots are also dark and more or less heavily outlined in reddish brown. The males may be distinguished from the females by the fact that the inner margins of their front wings are distinctly yellowish brown in color (Fig. 29, C). The lower or hind wings of both sexes are grey shading to brown at the margins.)

HOW TO RECOGNIZE THREE OF OUR MORE COMMON CUTWORMS

Maine has several very destructive cutworms which attack both field and garden crops in the spring. These include the black army cutworm, described above, the red-backed cutworm⁴, and the W-marked cutworm⁵. All three have the climbing habit and are active from the latter part of April until the middle or end of June, depending upon the season.

The red-backed cutworm. When full grown this cutworm is about one and one-half inches long. This species has a light stripe which runs along the middle of the back and separates the two broad red bands which give it a characteristic red-backed appearance (Fig. 30, H). The general body color is dark grey but the under surface as well as the true legs and pro-legs are lighter in color varying from grey to olivaceous. The body has a number of small, dark tubercles or swellings each of which bears a hair. The red color of the back, although not always pronounced, usually serves to distinguish it from others.

This form also has a wide range of food plants and is said to be the most destructive species occurring in Canada (9, p. 16). Many kinds of garden vegetables as well as oats, wheat, and barley are attacked. Under Maine conditions this insect has been especially destructive to peas, beans, oats, and potatoes.

The W-marked Cutworm. This cutworm may be readily distinguished from the two preceding because of the two rows of triangular black spots on the back. These marks are connected by faint lines to form a letter W on each body segment except the first three. The sides of the triangular black marks are bordered with bright yellow forming a continuous light line on either side of the W marks. (Fig. 30, F). The average length of the full grown caterpillar is a little less than an inch and a half.

The W-marked cutworm is also a very general feeder on many sorts of vegetables and on roots of grasses. Furthermore it has the climbing habit, feeding on the leaves and buds of the apple, currant, gooseberry and other plants. It was found feeding on the blueberry in company with the black army cutworm during the seasons of 1925 and 1926 in Maine fields.)

⁴*Euxoa ochrogaster* Gn.

⁵*Agrotis unicolor* Walk.

FOOD PLANTS

The black army cutworm feeds upon a variety of unrelated food plants according to Maine records and those from other sections. The following list includes members of 20 families totalling 40 different species of plants. Those marked with an asterisk are all Maine records while the rest are taken from observations made elsewhere.

FERN FAMILY

- * Fern

LILY FAMILY

- * Asparagus, *Asparagus officinalis* Linn.
Onion, *Allium* sp.

WILLOW FAMILY

- Poplar, *Populus* sp.
Willow, *Salix* sp.

SWEET GALE FAMILY

- * Sweet fern, *Myrica asplenifolia* Linn.

WALNUT FAMILY

- Black walnut, *Juglans nigra* Linn.

BIRCH FAMILY

- * Alder, *Alnus* sp.
* Birch, *Betula* sp.

BEECH FAMILY

- * Beech, *Fagus* sp.
Oak, *Quercus* sp.

NETTLE FAMILY

- Elm, *Ulmus* sp.

BUCKWHEAT FAMILY

- Dock, *Rumex* sp.
* Yellow sorrel, *Rumex crispus* Linn.

GOOSEFOOT FAMILY

- * Pigweed, *Chenopodium album* Linn.

MUSTARD FAMILY

Pepper grass, *Lepidium virginicum* Linn.

SAXIFRAGE FAMILY

* Flowering currant, *Ribes* sp.

ROSE FAMILY

- * Apple, *Pyrus Malus* Linn.
- * Chokeberry, *Pyrus melanocarpa* (Michx) Willd.
- * Meadow sweet, *Spiraea salicifolia* Linn.
- * Strawberry, *Fragaria Chiloensis* Duchesne
- Wild cherry, *Prunus* sp.
- * Wild raspberry, *Rubus strigosus* Michx.
- * Wild rose, *Rosa* sp.

PULSE FAMILY

- * Common pea, *Pisum sativum* Linn.
- * Cow vetch, *Vicia Cracca* Linn.
- * Red clover, *Trifolium pratense* Linn.
- * Sweet clover, *Melilotus alba* Linn.

CASHEW FAMILY

Sumach, *Rhus* sp.

MAPLE FAMILY

Box elder, *Acer negundo* Linn.
Maple, *Acer* sp.

DOGWOOD FAMILY

- * Bunchberry, *Cornus canadensis* Linn.

HEATH FAMILY

- * Laurel or "lambkill", *Kalmia* sp.
- * Low sweet blueberry, *Vaccinium pennsylvanicum* Lam.
- * Sour-top blueberry, *Vaccinium canadense* Kalm.

FIGWORT FAMILY

Mullein, *Verbascum* sp.
Wood betony, *Pedicularis canadensis* Linn.

COMPOSITE FAMILY

- * Aster, *Aster* sp.
- * Golden-rod, *Solidago* sp.
- * Sow thistle, *Sonchus oleraceus* Linn.

Naturally enough not all the plants in the foregoing list are equally attractive to the cutworms. It is interesting to notice that the rose family contains a number of the especially attractive plants. On the other hand it is likely that some of the plants listed are eaten only in cases of emergency when the preferred food has been consumed and the caterpillars are faced with starvation. However, it should be stated in that connection that in Maine generalized feeding did not take place until the caterpillars were nearly full grown and had stripped the blueberry (Fig. 29, B) and other favorite plants. Luggar (14, p. 48) makes the following statement regarding an outbreak in Minnesota: "The presence of these worms was painfully evident as they had devoured everything in the nature of a leaf, and had, prompted by hunger, even eaten the young bark of such plants as poplars, willows, cherry, sumach, and others". Our Maine observations and records indicate that the sow-thistle, pigweed, low-sweet and sour-top blueberry, wild red raspberry, meadow sweet, apple, strawberry and common pea are among the preferred food plants of this cutworm.

It is probable that further observations may greatly increase the extent of the foregoing list.

LIFE HISTORY

The life cycle of all cutworms includes 4 stages or forms—the egg, larva or caterpillar, pupa, and adult. The life-histories of the various species differ materially for some winter in the egg stage, some in the larval or caterpillar stage, some in the pupal stage, and a few in the adult or moth stage. In some cases depending upon the species and the climate there may be two or more generations a year.

The black army cutworm is recorded by Gibson for Canada (9) as spending the winter in the ground as a partly grown larva or caterpillar and as having only one generation a year. The smallest caterpillars taken by the writer in the spring of 1926 were about $\frac{5}{8}$ inch in length so it appears certain that a part of them, at least, must pass the winter as very small larvae unless indeed they hatch from eggs in the spring. The small overwintering caterpillars appear early in the spring and renew their feeding activities. As they become larger they cast their skins from time to time. In Maine the time of appearance varies from late April to early May.

Usually the larvae become full grown after feeding for five or six weeks. At that time they bury themselves in the ground, shed their last caterpillar skin, and rest in the ground in the form of a shiny brown "pupa". About three weeks later the pupal skin is broken and the adult moth emerges from it.

In 1925 the cutworms were present in vast numbers in Hancock County during the first week in May. In 1926 they did not appear until a month later in that county altho, in the southern part of the state, one specimen was taken on May 5. The range of the time of appearance within the state is therefore very great.

The first pupae reared from cutworms collected in Cumberland County in May 1926 were obtained on June 1, while the first pupa from the Hancock County collection (taken June 7) did not put in its appearance until June 21. The greatest length of time spent in the pupal stage was 24 days and the shortest period recorded was 16 days. The average length of time was $21\frac{1}{3}$ days.

The first adults or moths reared from the Cumberland County material emerged on June 16 and June 18, while those from the Hancock County collection did not emerge until July 13 and July 15, practically a month later. According to Canadian writers (9, p. 28) the moths are on the wing there from the middle of June to about the middle of September. The moths themselves do no harm except indirectly in laying the eggs from which the young cutworms hatch. In common with other cutworm moths the black army cutworm moth flies at night and feeds on nectar taken from various flowers. In 1876 Norman (16) observed the moths visiting spiraea blossoms. This is the only feeding record of the adult which the writer has found.

Just when or where the eggs are laid is not known, nor have we any definite record of the feeding habits of the small worms during the fall. Closely related species of moths are capable of laying several hundred eggs or more. These eggs are usually deposited on the leaves of various weeds, grasses, or shrubs.

HABITS

This species combines the habits of "climbing cutworms" and "army worms"; that is, they do not cut off their food plants at the ground but climb up on them in order to feed, and, when present in large numbers they adopt the army worm habit of

marching in a mass, devouring everything in the way of vegetation as they go. They crawl out of hiding about dusk and climb up the plants or shrubs. At daybreak or earlier they drop to the ground where they hide under surface rubbish or in loose top soil thruout the day.

In the blueberry fields this cutworm exhibits several peculiar habits. The first and most striking of these appears to be directly concerned with the practice of burning over the fields. Most blueberry growers burn their fields over every three years or so in order to renew their bushes (thus increasing their yields) and incidentally to destroy some of the less resistant weeds and shrubs competing with the blueberry bushes. Burning is usually done early in the spring and during that season no fruit is set. The following year (conditions being favorable) the heaviest crop is produced. Our records indicate that, unfortunately, these first crop or "new burn" pieces are the only ones attacked by the cutworm. The result is that the worms are always present (if present at all) on those fields where they can cause by far the heaviest losses. Whether the caterpillars are attracted by the succulent growth in the new fields or whether the moths are especially attracted to newly burned fields for the purpose of egg laying we cannot say, although the latter theory is the most logical one. In support of this theory Luggar observed (14) in Minnesota that after the great fire of 1893 all the foliage seemed to be to "the taste of these worms".

The severe outbreak of 1925 in Maine revealed another peculiar phenomenon. In a great many cases the ridges or higher parts of the blueberry fields were attacked first. The moths, which lay their eggs during the summer, might logically select the higher land for egg laying since at night there are often cold air currents in the lower parts of the fields. It would be natural to expect that the small worms would remain in or near these places until the food becomes scarce. The fact that the outbreaks in the spring were localized on the higher land and did not spread to the lower sections until the ridges had been stripped seems to support the egg laying theory. The 1925 attack was very striking, for practically everything in the infested fields was eaten.

TYPE OF INJURY PRODUCED

The early feeding of the black army cutworm and cutworms in general depends directly upon the temperature which prevails in the fields at night. The first injury may be expected during the first warm nights in late April or early May. The cutworms, especially at first, do not destroy the entire bud but simply eat out all or part of the inside and leave the empty bud scales. Therefore this type of feeding may easily be overlooked until the crop is actually damaged extensively, if the buds are not examined carefully at this time. As time goes on the bud scales turn brown and wither thus giving them the appearance of having been injured by early frosts. Consequently growers should watch their "new burn" fields very carefully in the spring when the buds are beginning to swell. Second or third crop pieces are not usually subject to attack so that observations made in such fields might be misleading. As soon as the first injured buds are noticed the grower should visit his field with a flash light the next warm night in order to see the worms actually at work. They are quite conspicuous because of their habit of climbing directly to the top of the plant and feeding on the terminal buds first.

There is little difficulty in recognizing the injury caused by this and similar cutworms during seasons of great abundance, such as 1925. Even during that year, however, the presence of the caterpillars was not discovered until large areas had been denuded and turned black. Such a condition is very striking and fields so attacked looked, in the words of the owners, "as though they had been swept by fire." By that time the cutworms had doubtless been at work for a period of one to two weeks and almost all of the plants in the blueberry fields should have been in leaf. Since the second crop fields were not attacked the contrast between their appearance and that of the first crop pieces was very marked. Even then many growers who had not seen the caterpillars actually at work were not convinced that their loss was not due to frost or some condition other than insect attack. Prior to their discovery that season, the cutworms had reaped the real harvest by destroying the fruit buds but they were so abundant that as they continued to feed in the fields they stripped the foliage of the blueberry and many other plants. During seasons of normal infestation there is usually enough food in or near the berry fields so that even if the

fruit buds have been destroyed the later feeding on the leaves is not very noticeable. To the casual observer at that period the bushes may appear healthy enough and later when they fail to bloom a number of different reasons may be assigned.

METHODS OF CONTROL

1. *Natural.* There are several natural factors which influence the abundance of this and other cutworms. Our native birds are of great value in this connection for they consume quantities of caterpillars. The crow, gull, blue jay, robin, blue bird, and many others are especially active and beneficial.

Climatic conditions play an important role in the abundance of cutworms and other insects. Sudden changes from very cold to rather warm weather during the winter tend to destroy all species of cutworms. Heavy rains during the fall often result in the reduction of their numbers by drowning. Early springs often make their presence more pronounced (especially climbing forms) probably because the worms emerge from the ground during such seasons before there is very much vegetation and, consequently, they are forced to feed upon swelling buds.

Fungous diseases which may destroy countless numbers almost overnight are spread by certain combinations of moisture, temperature, and humidity. Gibson (9, p. 12) states that, "On several occasions when the black army cutworm was abundant in eastern Ontario, it was largely destroyed by *Empusa virescens* Thaxter."

The weather also regulates, to some extent, the abundance and activity of parasites, a number of which have been reared from the black army cutworm. The eggs of a Tachinid fly (Fig. 29, D) were found on a great many of the caterpillars in Maine during the seasons of 1925 and 1926. The following parasites have been reared from this cutworm in various localities: the Tachinid fly (*Phorichaeta* (Scopolia) *sequax* Will.), The Tachinid fly (*Phorocera claripennis* Macq.), the Bombyliid fly (*Anthrax alternata* Say), the Therevid fly (*Psilocephala haemorrhoidalis* Macq.), and the Braconid wasp (*Meteorus vulgaris* Cr.)

There are also several important predaceous enemies of the black army cutworm including the spined soldier bug, the fiery ground beetle (*Calosoma calidum* Fab.), the large Harpalus (*Harp-*

palus caliginosus Fab.), and several species of wasps which either feed on cutworms directly or collect them for their young.

2. *Artificial.* There are several methods of cutworm control which are applicable to garden or field crops in particular. Foremost among them is the practice of clean cultivation. Cutworm moths, for the most part, lay their eggs on weeds or other vegetation toward the middle or end of the summer. Clean cultivation, by keeping down the weeds in and about the field or garden, greatly reduces the egg laying possibilities in that vicinity. Fall ploughing is also of considerable value in destroying the small hibernating caterpillars as well as the pupae.

Cabbages, tomatoes, and certain other plants which are set out each spring may be protected by placing a band of tarred paper, tin, or cardboard around each one until the worms have finished feeding.

Fruit trees and grape vines (19) may be effectively protected by banding the trunks with tree tanglefoot. This substance will usually remain sticky thruout the period of attack and it can be readily applied by means of a wooden paddle. The caterpillars are not caught in the tanglefoot but they will not crawl over even a narrow band an inch or so in width.

In gardens or small fields hand gathering may sometimes be practicable. The cutworms may be located during the daytime at the base of the plant attacked. It is much easier, however, to go out in the garden at night with a lantern or flash light. At that time they may be collected and destroyed without much effort.

Although spraying or dusting with arsenicals doubtless has some value it is not a practical method of control, especially in large blueberry fields. The foliage grows so rapidly in such areas that fresh, unpoisoned growth is constantly available. Furthermore the caterpillars are quite resistant to normal dosages of arsenicals.

The most effective control either in small gardens or large fields may be obtained by the use of poisoned baits. There are many formulas for the preparation of poisoned bran mash. The following formula has proven satisfactory in the control of the black army cutworm:

Bran	20 pounds
Paris green or finely powdered white arsenic....	1 pound
Molasses.....	2 quarts
Water (enough to moisten).....	about 3 gallons

In preparing the bait first mix the dry ingredients, bran and Paris green or white arsenic, together thoroly. Then mix the molasses and part of the water until all the molasses is dissolved. The two mixtures should then be combined and more water added, a little at a time, until the whole mass is evenly moistened. It is important that the bran should not be wet or sloppy but that it should crumble readily. If permitted to stand a few hours before using the poison will be more evenly distributed thruout the bran. Lead arsenate or calcium arsenate are not effective as substitutes for Paris green, and white arsenic, unless it be finely powdered, is of little value.

Since the worms work at night and since the mash is not effective if dried out it should not be applied until sundown or later.

11,281 Cook (5) states that bait without molasses is worthless as far as the black army cutworm is concerned and he recommends using an excess of it. This is in contrast to the experience of certain other workers who find that for some cutworms an attractant, such as molasses, is unnecessary.

In gardens the bait should be broadcasted along the rows by hand. If it is thinly and evenly scattered there is little danger of poisoning poultry or livestock. In large areas such as blueberry fields vast quantities might be required if the whole section had to be broadcasted. Usually, however, the line of march can be determined and a good supply scattered along just in front of it every evening until control is obtained. Sometimes entire localized areas such as ridges or knolls may be treated to advantage.

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FIG. 29. Black army cutworm and work: A, full grown caterpillar; B, typical work on blueberry—buds destroyed; C, moth (male); D, caterpillar showing white egg of parasite; E, pupa.

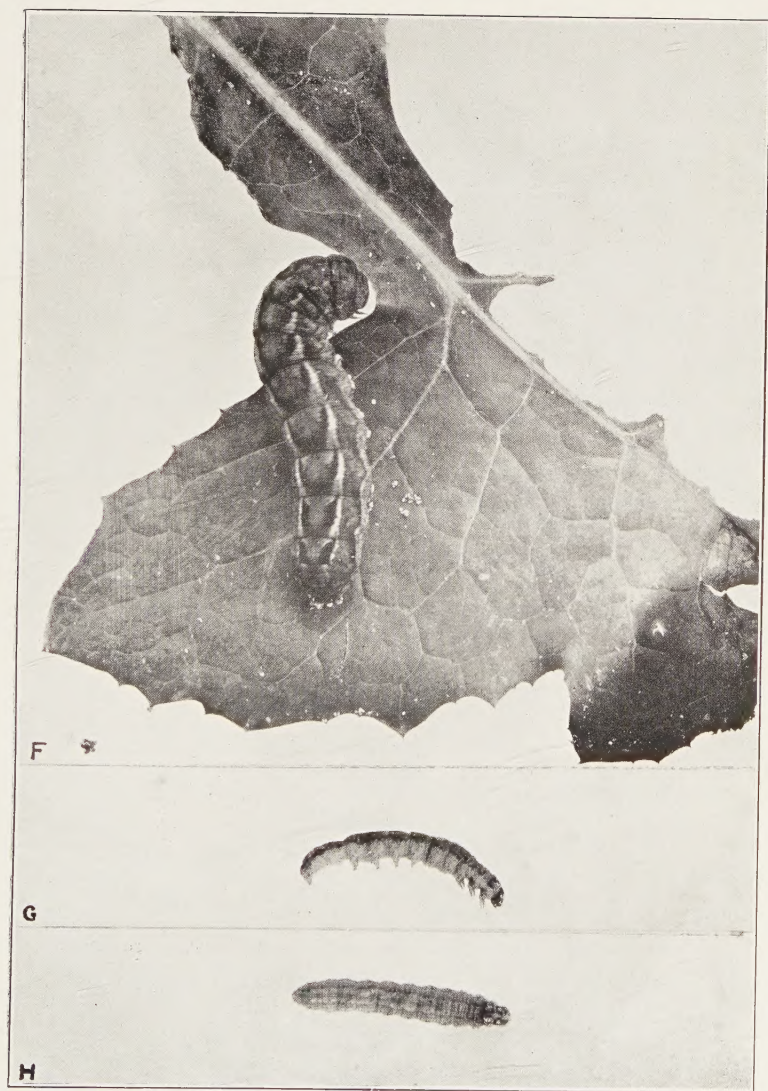


FIG. 30. F, W-marked cutworm (somewhat enlarged) ; G and H, dorsal and side views of the red-backed cutworm (preserved material).

